Patent Application of

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for

TITLE OF INVENTION: SHIELD FOR WALL PENETRATION OF FLEXIBLE TUBING

CROSS-REFERENCE TO RELATED APPLICATIONS Not Applicable

FEDERALLY SPONSORED RESEARCH Not Applicable

SEQUENCE LISTING OR PROGRAM Not Applicable

BACKGROUND OF THE INVENTION—FIELD OF INVENTION

This invention relates to a combination sleeve and bracket used to install and protect flexible tubing during and after building construction.

BACKGROUND OF THE INVENTION

Flexible tubing is often installed in the new construction or renovation of residential or commercial buildings. An example is a refrigerant line-set, which is typically installed to interconnect split system air conditioning equipment. Flexible tubing may also be used in plumbing or fire sprinkler systems. The refrigerant line-set is probably the most prevalent usage of the invention. A line-set generally consists of two lines of copper tubing. The smaller of the two, the liquid line, is usually not insulated. The larger suction line is typically insulated. The purpose of the line-set is to tie together an outdoor air conditioner or heat pump to an indoor coil or air handler. Liquid and vapor refrigerant is pumped through the line set. The line-set is often routed through an attic or floor/ceiling assembly and then turned down into an outside wood or metal stud

wall. Within generally 12" to 24" of the floor, the line-set turns and penetrates the outside wall siding.

The line-set is usually installed during the "rough" framing portion of the project. At this time there is usually some form of insulation board, particle board, plywood, etc. that is installed on the outside of the "studs", or vertical framing members. However, very often the final building siding is not installed at this point. Examples may include lap siding, sheet siding, brick, stucco, stone, etc. These are installed over the insulation board etc. at a later date in the construction process.

The usual installation of the line-set involves cutting a hole in the interior sheathing and installing the tubing through the hole at an approximate 20 to 75 degree angle. The tubing typically cannot be bent a full 90 degrees because it will "kink". A kink is a compression of the inside area of the tubing when it is bent to too sharp of an angle. The same process occurs when a drinking straw is bent too sharply. With many types of tubing, including copper, a kink usually cannot be repaired. It must be replaced.

After the installation personnel have installed the tubing at the correct angle, the tubing terminates outside the wall anywhere from a few inches to a few feet from the wall. The tubing is left at this point in the construction process without connecting it to an air conditioner or heat pump. The equipment is usually set later in the "trim" stage of the project after the exterior siding is installed. Quite often, later in the construction project, personnel from another subcontracting trade on the project will manually move the protruding tubing on the outside of the building. A major example is the exterior siding subcontractor. Brick masons will often move the tubing to a position where it protrudes from the wall at a 90-degree angle. This makes the bricks easier to install. A problem is created at that point because the tubing is generally kinked inside the wall. This problem may not be discovered until the project is almost complete. Since the tubing is kinked, the air conditioning system will not operate correctly. At this point in the project, the exterior sheathing has already been installed as well as the dry wall on the inside. The interior paint and carpet, as well as exterior paint are usually complete at this time. The only way to repair the kink is to cut either the dry wall on the inside or the exterior siding. This potentially causes other problems. To repair the kink, the kinked portion of the tubing must be cut out and a new 90-degree elbow, coupling, new tubing

etc. are installed. These are soldered using high temperature torches. Since there is typically flammable material in close proximity such as wood framing, insulation, and exterior sheathing, this presents a significant fire hazard.

There is quite an expense involved when repairing this problem. This may involve repairs to drywall, siding, brick, interior paint, exterior paint, carpet cleaning and of course the tubing itself. There is also quite an expense to repair the problem because in order to open the copper tubing, any refrigerant must be recovered in accordance with the Environmental Protection Agency guidelines. The tubing is usually leak tested. Then the system must be recharged with refrigerant.

Although other personnel on the construction project usually cause the above problems, sometimes the personnel that install the tubing cause the problem. This can happen without the knowledge of the installer because the suction line tubing is generally insulated with pipe insulation. This shields potential kinks from view. Because the tubing is installed through a rough-cut hole in the outside wall, there is nothing to regulate the angle of the bend in the tubing. If this problem occurs, it has the same results as when other personnel on the project cause the problem.

Quite often the line set is installed through a hole in the outside sheathing with nothing covering the hole from view. This can be visually unappealing. One common practice is to install a hooded piece of sheet metal or plastic over the tubing on the outside of the exterior sheathing. This hood resembles wall caps commonly used for air exhaust applications such as exhaust fans or clothes dryer vents. These covers are installed after the exterior sheathing and have no effect of protecting the copper from being kinked. They are mainly installed for their appearance or possibly to prevent water leaks.

Another common problem with the exterior wall penetration of tubing is that rainwater can enter through the hole. The hole in the sheathing is usually caulked or spray foam is applied around the tubing. The pipe insulation around the tubing makes it difficult to have a solid surface to apply the caulking or foam. In addition, the caulk, foam, or insulation may degrade over time and cause water infiltration at a later date.

BACKGROUND OF INVENTION—OBJECTS AND ADVANTAGES

Several objects and advantages of the invention are:

(a) to provide a device to protect flexible tubing from kinks inside the wall due to manual adjustment of the tubing from outside the wall.

(b) to provide a device to make it easier to install tubing without kinking.

(c) to provide a device that improves the appearance of the tubing where it penetrates the exterior siding.

(d) to provide a device that reduces the potential for water infiltration around the tubing into the wall.

(e) to provide a device that reduces lost time on construction projects due to damage and repairs to flexible tubing.

Still further objects and advantages will become apparent from a consideration of the ensuing description and drawings.

BRIEF SUMMARY OF THE INVENTION

In accordance with the present invention the shield comprises a square, rectangular, or round sleeve with a nail or screw plate attachment attached at a fixed angle.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

Figures 1, 2, and 3 show different embodiments. Each embodiment is shown in similar detail with different alphabetic suffixes.

Figures 1a through 1f show a shield with a flat side attachment device.

Figures 2a through 2f show a shield with one top and one mid body attachment device.

Figures 3a through 3f show a shield with an angled side attachment device.

Figure 4 shows a shield installed in place from a view of an outside wall. This view is the same in all embodiments.

DRAWINGS – REFERENCE NUMERALS

10	Sleeve
12	Attachment plate
14	Attachment holes
16	Intersection of sleeve and attachment plate
18	Attachment hardware
22a	Lower attachment Angle
22b	Upper attachment Angle
26	Intersection of sleeve and attachment Angle
32	Attachment Angle
36	Intersection of sleeve and attachment Angle
40	Interior Sheathing
42	Exterior Sheathing
44	Wall Siding
46	Framing stud
48	Flexible tubing, wiring, or cabling
50	Sealant
ϕ	Angle between sleeve and attachment plate or angle

DETAILED DESCRIPTION OF THE INVENTION

Figures 1a through 1f.—Preferred embodiment

A preferred embodiment of the device is shown in figures 1a through 1f. A sleeve **10** has a cross section that is rectangular, square, or round. A rectangular cross section is shown. It is open through the middle such that flexible tubing or cabling may be installed

through. The sleeve is constructed of a durable material such as metal, PVC, or plastic. An attachment plate **12** is attached to a side of the sleeve **10** at an angle ϕ. Attachment plate is mechanically attached to sleeve by any structurally sound method depending on the material. Metal parts may be welded, screwed, bolted, riveted, etc. Plastic may be molded in one assembly, screwed, bolted, etc. This angle is equal to or less than the maximum angle at which the installed tubing **48** can be bent without kinking and is generally between 20 and 75 degrees. The intersection of the sleeve and attachment plate is point **16**. This point is located at the edge of the sleeve such that there is a maximum amount of room for the tubing to bend when it transitions from the wall to the sleeve. The attachment plate **12** has attachment holes **14**.

Figures 1e and 1f show the device installed in an exterior frame wall of a building. The attachment plate **12** is installed flush with a framing stud **46**. Framing studs are typically constructed of solid wood lumber or metal. Attachment hardware **18** such as screws, bolts, nails, or rivets pass through attachment holes **14** to framing stud **46**. Flexible tubing **48** is installed in the stud cavity enclosed by studs **46**, interior sheathing **40** and exterior sheathing **42**. The device with tubing passes through the exterior sheathing **42** and wall siding **44**. Interior sheathing **40** typically consists of dry wall, plaster, or paneling. Exterior sheathing **42** typically consists of rigid sheet material such as insulation board, plywood, or particleboard. Wall siding **44** typically consists of lap siding, sheet siding, brick, stone, or stucco. A sealant **50** such as caulking, spray foam, etc. forms a weatherproof seal between the tubing **48** and the sleeve **10** as well as between the sleeve **10** and wall siding **44**.

Figures 2a through 2f.—Additional embodiment

An additional embodiment is shown in figures 2a through 2f. This embodiment is similar to that shown in figures 1a through 1f except for the attachment means. Attachment Angles **22a** and/or **22b** are attached to the front and/or back side of the sleeve **10** at an angle ϕ. This angle generally is between 20 and 75 degrees. The intersection of the sleeve and attachment angle **22b** is point **26**. The attachment angles have attachment holes **14**.

Figures 2e and 2f show the device installed in an exterior frame wall of a building. The attachment angles **22a** and **22b** are installed flush with exterior sheathing **42**. Attachment hardware **18** such as screws, bolts, nails, or rivets pass through attachment holes **14** to exterior sheathing **42**. Flexible tubing **48** is installed in the stud cavity enclosed by studs **46**, interior sheathing **40** and exterior sheathing **42**. The device with tubing passes through the exterior sheathing **42** and wall siding **44**.

Figures 3a through 3f.—Additional embodiment

An additional embodiment is shown in figures 3a through 3f. This embodiment is similar to that shown in figures 1a through 1f except for the attachment means. Attachment Angle **32** is constructed of a durable material such as metal, PVC, or plastic that has a cross sectional shape of a right angle. Attachment angle **32** is attached to the side of the sleeve **10** at an angle ϕ. This angle generally is between 20 and 75 degrees. The intersection of the sleeve **10** and attachment angle **32** is point **36**. The attachment angle **32** has attachment holes **14**.

Figures 3e and 3f show the device installed in an exterior frame wall of a building. The attachment angle **32** is installed flush with exterior sheathing **42**. Attachment hardware **18** such as screws, bolts, nails, or rivets pass through attachment holes **14** to exterior sheathing **42**. Flexible tubing **48** is installed in the stud cavity enclosed by studs **46**, interior sheathing **40** and exterior sheathing **42**. The device with tubing passes through the exterior sheathing **42** and wall siding **44**.

Figure 4 – Exterior detail

Figure 4 shows an exterior detail view of the device as installed in a building frame wall. Sleeve **10** protrudes through the siding **44**. Flexible tubing **48** passes from the inside of the wall cavity through sleeve **10** and to the exterior.

OPERATION

Figures 1a-1f, 4 Primary Embodiment

The shield is installed in an outside frame wall of a building. If the exterior sheathing **42** has been installed, a hole is cut in the sheathing to match the size and shape of the sleeve **10**. The hole is cut whereby the side of the hole is flush with the side of the stud **46**. The shield is installed through the sheathing **42** at an angle such that the attachment plate **12** is parallel to the framing stud **46**. At least one attachment hardware **18**, i.e. a screw, nail, bolt, or rivet is installed through the attachment hole **14** in the top of the attachment plate and at least one more in the hole(s) in the bottom of the attachment plate **12**. If the sheathing **42** has not been installed, the installation is similar except that it is not necessary to cut the hole.

Flexible tubing **48** is then installed running from inside the stud cavity surrounded by the studs **46**, interior sheathing **40**, and exterior sheathing **42**. This step may be immediately after the shield installation or thereafter. In any case it is generally before the interior sheathing is installed. The tubing passes through the sleeve **10** and out of the exterior wall. There may be one or more lines of tubing installed in one shield. One or more of the lines of tubing may be insulated. Wiring may also be installed through the shield.

After the shield has been installed, wall siding **44** is installed over the exterior sheathing **42** and around the sleeve/tubing assembly. This may be before or after the tubing has been installed.

Finally the shield assembly is sealed as necessary. This may include caulking, spray foam etc. The sealant **50** is installed inside the sleeve **10** between the tubing and the sleeve as well as between the sleeve and the wall siding **44**.

OPERATION

Figures 2a-2f, 4 Secondary Embodiment

The installation of this secondary embodiment is similar to that of the primary embodiment except for the attachment means. The shield is attached to the exterior sheathing **42**. This embodiment therefore must be installed after the exterior sheathing. At least one attachment hardware **18**, i.e. a screw, nail, bolt, or rivet is installed through the attachment hole **14** in the attachment angle **22b** and at least one more in the hole(s) in attachment angle **22a**.

OPERATION

Figures 3a-3f, 4 Secondary Embodiment

The installation of this secondary embodiment is similar to that of the primary embodiment except for the attachment means. The shield is attached to the exterior sheathing **42**. This embodiment therefore must be installed after the exterior sheathing. At least one attachment hardware **18**, i.e. a screw, nail, bolt, or rivet is installed through the attachment hole **14** in the top of the attachment angle **32** and at least one more in the hole(s) in the bottom of the attachment angle **32**.

ADVANTAGES

A number of advantages of the shield become evident:

(a) The flexible tubing is protected from kinks inside the stud cavity after installation. The shield is sufficiently strong such that it cannot be moved by manual pressure. The tubing can only be bent to the established angle of the sleeve to the stud cavity. It is therefore virtually impossible to kink the tubing inside the wall due to manual pressure on

the tubing or the sleeve from the outside. If enough pressure is exerted on the tubing from outside the wall, the tubing can only be kinked on the outside of the wall at the end of the sleeve. In this case the tubing can generally be repaired from the outside without damaging the building.

(b) The flexible tubing is protected from kinks during installation. The shield regulates the angle that the tubing must be bent in order to install the tubing through the wall. This reduces the possibility of kinking during installation of the tubing.

(c) The appearance of the tubing penetration of the outside wall is improved over the prior methods. Rather than having an irregular hole in the wall for one or more different sizes of tubing, the hole for the penetration is easily cut in the shape of the sleeve. In the case of having multiple applications on a project, all of the tubing penetrations are uniform in appearance.

(d) The chance of water penetration into the wall is significantly reduced. Since the sleeve is installed at a down facing angle, any water that comes in contact with the sleeve drains down the sleeve and away from the wall siding. Therefore, even if sealing is incorrectly installed or even not installed at all, the chances of water infiltration is greatly reduced. If sealing were not installed inside the sleeve between the sleeve and the tubing, water would have to travel up the sleeve in order to get into the building.

(e) The construction schedule of the building project is compressed. Time spent repairing problems is reduced as shown above.

CONCLUSION, RAMIFICATION, AND SCOPE

Accordingly, the reader will see that the shield provides a method to improve the overall quality of a tubing or cable installation through an exterior wall on a new or existing building. The chances of problems on the jobsite due to the kinking of flexible

tubing or cabling are reduced dramatically. The occurrence of kinks inside the wall is virtually eliminated. This eliminates the necessity of repairs to the tubing or cabling, drywall, exterior siding, or wall insulation. The necessity of recharging air conditioning or refrigeration systems is also eliminated. It also eliminates the need to clean carpets due to the debris and dust generated during the repairs as well as any new paint on the interior or exterior walls. Because the necessity of soldering inside the wall is eliminated, so is the chance of a fire.

The installation of a shield with the tubing or cabling also provides a very professional, neat appearance as opposed to the usual rough-cut holes usually seen. The penetration in the building siding around the sleeve is a regular shape such as rectangular, square, or round. In the case of having several different sets of tubing or cabling on a project, the installation is consistent from one set to the next.

The shield significantly reduces the chance of water infiltration into the building. Most current methods of installing tubing or cabling in a wall completely depend on caulking or sealants to provide a weatherproof seal. The shield, due to its downward sloping penetration, naturally drains water away from the wall. The shield also provides a regular intersection with the building siding so that a sealant can be neatly and effectively installed.

The shield may also save time on the construction schedule due to the savings in the time spent conducting the repairs. This can be quite significant because to the involvement of many different subcontractors in repairing problems related to the kinking of the tubing or cabling. These possibly include the drywaller, insulation subcontractor, building siding subcontractor, painter, carpet layer, and of course the mechanical subcontractor.

Although the description above contains much specificity, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. For example, the shield could comprise of the sleeve as shown without the attachment angles or plates. Holes for screws, nails, etc. could be located in the sleeve itself. In addition, the sleeve could have one or both ends cut at a different angle than the 90-degree angle as shown.

Thus the scope of the invention should be determined by the appended claims and their legal equivalents, rather than the examples given.